until the recruit is prepared for heavy work, if the worry and strain is sufficiently relieved by reaction, games and camp shows, these men, oftentimes of the finest spiritual and patriotic fiber, are certain to make good soldiers, competent and spiritually equal to great and heroic deeds; but if, on the other hand, unhappiness comes or overly heavy or premature physical work are imposed, and perhaps the ridicule or worse of men of more rugged or phlegmatic temperament keeps the young soldier in a condition or a state of unhappiness and fear, he breaks either nervously or cardiac incompetence ultimately develops. This I have also seen in ambitious young men of the higher, more spiritual type who have at once striven to excel in their work and studies and to whom rapid advancement has meant unprepared-for responsibilities and worries.

The subject is an important one to us all at this time. It has been a most astonishing revelation to me, and I think to most civilian physicians who have been called into active service, and I feel that earnest study with a liberal adaptation of the excellent suggestions which have been worked out by our more experienced allies will permit us to salvage a considerable and very valuable human material which we will doubtless sorely need before many of us are able to lay aside our uniforms and return to our homes and the normal life which we all crave to such a degree that we are happy to fight for it.

EFFECTS OF "MUSTARD GAS" ON THE EYES.

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Lacrimatory gas was first used by the Germans to disable their opponents temporarily at the time of an attack. Its effects wore off very quickly and no harmful results remained.

In July, 1917, U. S. Army Base Hospital No. 5 and other hospitals in the vicinity began to receive a large number of cases poisoned by a new sort of gas which produced lesions of the eyes, the respiratory system and the skin. Since that time we have had perhaps 500 of these cases to treat.

Mustard gas is not sent over in clouds but in shells and its action is a delayed one, as it vaporizes slowly. It will hang around a locality in which it has been sent over for many hours. As this gas produces inflammation of the eyes in at least 80 per cent. of cases it is important that our medical officers should be able to recognize and to treat the ordinary case, and that our ophthalmologists who are coming over here should be well informed and prepared to help their medical and surgical confrères when asked for advice, and asked they frequently will be.

In these notes I propose to confine myself chiefly to the ocular effects of the so-called mustard gas.

Dichlorethylsulphide, popularly known as mustard gas, is a dark brown liquid which vaporizes slowly. It has a faint but fairly distinctive odor, easy to recognize but hard to describe. It works best in the presence of moisture, and therefore it affects most the mucous membranes and the moist portions of the skin, the axillary folds and the genitalia. A well-constructed gas mask is impervious to its fumes, but naturally will not prevent the skin lesions.

The direct effects of mustard gas are usually not immediate, but are delayed for from three to eight hours. The soldier vomits, his eyes begin to burn and water and the lids often swell. The respiratory passages are very irritable and severe attacks of coughing come on. The skin lesions are seen later and vary in severity from a mild erythema to marked development of bullæ on the affected parts.

Many cases are gassed so mildly that they may return to duty in a few days and are not sent down to the Base. A large number, however, must be sent down and are kept in the Base Hospitals for a period varying from one to four weeks. They are then (in the British service) sent on to a convalescent camp and after a stay there of perhaps the same length of time they may be returned to their military base and so on back to their unit. The mortality is in the nieghborhood of 2 per cent. and the commonest cause of death is bronchopneumonia.

OCULAR LESIONS. As mentioned before, some 80 per cent. of the cases we have received show eye lesions of greater or less severity. The lesions are of the nature of a chemical burn of the skin of the lids, conjunctivæ and of the corneæ in a considerable percentage.

THE LIDS. The picture presented by the patient whose eyes are severely affected is sufficiently striking. The lids are reddened, swollen and often show numerous large bullæ; they are kept tightly closed. The French speak of a true ulceration of the lid margin occurring most often in cases of pneumonia. This we have not observed.

The irritation and photophobia are so intense that not infrequently resort must be had to one or two drops of cocain and the use of a lid elevator in order to make a proper examination of the eye. Separation of the lids is often followed by a gush of tears.

The appearance of the conjunctivæ varies with the severity of the case. In the milder ones there is but slight injection, nearly always accompanied by slight photophobia. In the more severe cases we get a severe injection and at times a very marked white edema and chemosis of the membranes. These appearances are usually most marked in the area of the palpebral fissure. A secondary infection of the conjunctiva following gassing is not at all uncommon. Ciliary injection is frequent. In the more severe gas cases a careful examination, made with proper illumination and the corneal loupe, will nearly always disclose a certain amount of corneal involvement, varying from a slight roughening of the epithelium to a well-defined opacity, usually in the form of a band extending across the cornea in the area corresponding to the palpebral fissure. In appearance this band in certain instances may assume an almost porcelain whiteness, but this is rare.[1]

The French speak of ulceration of the corneæ as being common. In our experience it is rare. Personally, I have seen but three cases with a definite loss of substance. The first of these died about two weeks after being gassed, the second could not be followed, as he was evacuated to England. The third was transferred to the principal British eye hospital after being for ten days in another hospital. This case showed a severe central corneal ulceration with hypopyon. In spite of a Saemisch section the condition progressed and the eye was lost. Our British colleagues have seen a few corneal ulcerations, also usually of rather a mild type.

According to the French these corneal lesions are stained by fluorescein. In our experience they are not except in rare instances.

The corneal condition tends to disappear rapidly, leaving no trace, except in the cases with ulceration.

As a result of the corneal irritation one often gets a small pupil which may require the use of atropin three or four times a day to secure a satisfactory dilatation. In most instances, however, a drop of a 1 per cent. solution twice a day will act sufficiently.

Some observers have tried to make more or less of a mystery of the intense photophobia which occurs so frequently. This may quite certainly be explained by the corneal involvement.

Tellières has described a neuroretinitis characterized by a peculiar slate color. Fundus observations through a cloudy cornea are, however, difficult, and his findings have not been confirmed.

PROGNOSIS. Cerisé in his report to the Société d'Ophtalmologie divides these cases into three groups:

1. Benign: Representing 10 to 15 per cent. of cases. Duration ten to fifteen days.
2. Medium: About 80 per cent. of cases. Duration five or six weeks.
3. Severe: 3 to 5 per cent. seen in those with marked general symptoms, who often develop a bronchopneumonia.

Our experience would tend to put a larger proportion of cases in the benign class.

Although not possible to quote figures it may be said, speaking entirely from the ocular standpoint, that nearly a third of the cases may be discharged to duty in a week and that a third more may go back by the end of the second week. In perhaps a fifth of the cases the duration is three or four weeks and the small remainder run a course up to two months. With very rare exceptions complete recovery results.

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[1] Probably in these cases some of the fluid has come into direct contact with the cornea.

Men who are subject to blepharitis and conjunctivitis are more sensitive to gas.

Following exposure to mustard gas one sees a considerable number of patients, mostly those of unstable nervous system, who complain of photophobia and blepharospasm of a functional nature. The ocular membranes in these cases are normal or show at most a slight hyperemia. Such cases should, after a careful examination, be treated as purely functional treatment.

TREATMENT. Mustard gas burns of the eye, although tending toward spontaneous recovery, deserve careful supervision and treatment, since good treatment will shorten their convalescence, make them much more comfortable and ensure a complete recovery, except perhaps in the rarest instances.

The eyes should be protected from light but not bandaged. The patient should be kept in a moderately shaded ward. Eye shades which are satisfactory can be made out of three or four thicknesses of the blue paper in which various hospital supplies are wrapped.

The eyes should be gently irrigated in severe cases every three or four hours with some bland solution. Normal saline, soda bicarbonate 1 per cent., or boric acid are all good, best heated to about 100° F. before using. Following this a drop of liquid paraffin may be instilled or in the later stages argyrol in a 25 per cent. solution is found to be soothing. Castor oil theoretically is good, as mustard gas is dissolved by animal and vegetable but not by mineral oils. In practice, however, it is found to be more irritating than liquid paraffin.

Atropin should be used in all cases in which the cornea is involved and a 1 per cent. solution instilled twice a day will usually be found to keep the pupil well dilated. As a rule, atropin may be discontinued in two or three days, but not in those cases with marked corneal involvement.

Cocain should not be used as a routine, but is valuable for the first examination of the eye to relax the spasm of the lids.

Dionin in 5 per cent. solution has been tried in gas cases but discarded.

When hyperemia of the conjunctivæ exists for a long time a mild astringent collyrium may be used.

As the irritation subsides the corneal condition clears and the injection begins to disappear. Then it is very important to get these patients up and to accustom them to a greater degree of illumination.